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A RATIONAL APPROACH TO TRANSPORT PLANNING FOR THE FAR NORTH

by

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PREFACE

The purpose of this paper is to derive some sort of "rational approach to northern transportation planning". As philosophers and others have written volumes on the problem of "what is rational" and the amount and diversity of literature on transportation planning is simply staggering, it has been necessary to take a somewhat selective approach to the question posed by the title of this paper. The main theme of the discussion that follows is that it is necessary to be fully aware of the major problems and limitations involved in northern transportation planning before attempting to formulate solutions to these problems.

The first part of this paper discusses in general terms the role of transportation as a development tool and some of the broader aspects of the present development of the Yukon and the N.W.T. (hereafter referred to as the North). The second section of the paper discusses some of the major problems of transport and transportation planning in the North and also discusses some proposed solutions to these problems. As it is impossible to discuss <u>all</u> the problems of northern transportation (and transportation planning) in a paper of this length, or perhaps any length, the discussion focusses on what are felt to be the major considerations and difficulties that one must be aware of in order to formulate rational approaches to the northern transportation problem. The third section of the paper attempts to come to grips with the tricky question of - what is a rational approach to northern transportation

PREFACE

planning?

All the views and ideas propounded in this paper are those of the author alone and they should not be interpreted as reflecting official Federal Government policy.

The guidance and assistance rendered by E.R. Weick in the preparation of this paper is gratefully acknowledged.

I. INTRODUCTORY REMARKS

Transportation may be looked upon as those methods which attempt to bridge the time and space gaps between buyers and sellers in an economic system.(1) The object of transportation is to move people, goods, services, and information from one place to another in the most efficient (i.e. least costly) manner possible. The paramount importance of transportation as a development tool is accepted as a "natural law" here as no viable body politic can exist without adequate transportation facilities; indeed, societies are built around and accommodated to their transportation networks.

Historically, transport technology and the availability (or lack of) adequate transportation facilities has been the crucial factor determining development in the North. The major economic activity in the North has been, and appears likely to remain so for some time, the exploitation of natural resources of all kinds. This exploitation has been an almost direct function of the development of transport technology. Thus, the first resources exploited were those with a high value to weight factor, such as gold, silver, and furs. More recent times have seen a vast improvement in the ability of transportation to cope with northern problems, and cheaper technology has increasingly made possible the harvesting of lower value bulk materials such as iron, copper, asbestos, lead, and zinc, mostly from the southern part of the territories.

The traditional provision of transportation facilities to serve one resource area has resulted in a sort of "pin-pricked" development of the North, with many small settlements being separated by

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(1) D.F. Pegrum, Transportation: Economics and Public Policy. Richard D. Irwin Inc., Homewood, Illinois, 1968. P.4.

large distances. Military considerations and major "natural" transportation arteries (eg. Yukon River, Mackenzie River) have also played a large role in the development and settlement pattern of the northern territories. This type of development is likely to continue for some time, although hopefully in a somewhat improved and modified form, as the volumes required for a traditional transport network are simply not possible (except for temporary peak loads) in the foreseeable future.

Transportation can be used to influence, indeed, it can even be argued determine the pattern and rate of economic development of an area. Given the need for public sector involvement in providing some transport infrastructure[2] and formulating transport policy, the great importance of a sound public transport policy is readily apparent.

II. NORTHERN TRANSPORTATION PROBLEMS

The North is at the same time a simple and a very complex area. The complex elements of the northern scene cause innumerable problems of transportation and planning for transportation to arise. As it is virtually impossible to be either all inclusive or all knowing in this regard, the following discussion deals only with what are felt to be the major problems and considerations of northern transportation planning.

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(2) Public involvement is necessary to (1) regulate rates and establish standards, and (2) provide certain infrastructure projects. This latter aspect requires a public input as the market cannot effectively allocate transportation resources in many cases - highways, navigational aids, streets, etc.

(a) Perspective

A first difficulty encountered in any discussion of Canada's North is that the situation must be put into its proper perspective. To start with, while the North has about 40 per cent of Canada's surface area, it also has less than 1/4 of 1 per cent of her total population. Thus, when demands are made that the government must develop the North by providing cheap transport[3], it must be remembered that the rest of Canada is also placing heavy demands on governments' limited transportation budgets.

The oil discoveries on Alaska's North Slope brought the usual "transport = economic growth" advocates out to plead for a rail line or at least a road to the North Slope area, and the "scandal" of no surface transport to this rich resource area was on every Alaskan's lips.[4] The private companies, however, are managing quite well in the North Slope Area despite the lack of this "development key". At present, the North Slope sites are being supplied by air, barges up the Mackenzie River, and overland by cat train and various tracked vehicles. As a general comment, a cautious response is warranted to those who claim that we must have cheap public transport for economic growth.

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(3) The problem with the term "cheap" transport, of course, is that it means different things to different people. To users of a new public facility who are absorbing a miniscule part of the total cost of the facility, the investment may appear cheap indeed. However, such an investment may be considered anything but cheap to heavily burdened taxpayers and a government faced with other competing priorities within a limited budget.

(4) E.C. Haefele, "Transport in the North - A Case for International Cooperation." Papers of the Tenth Annual Meeting, Transportation Research Forum, 1969. P.151.

Per capita government expenditures on transportation facilities in the North, considerably exceed those for the rest of Canada. Table 1 shows total Federal Government expenditures on roads in Canada, and from the table it can be seen that per capita government expenditures on roads in 1968 for the Northwest Territories were approximately five times as high as those for Canada as a whole and in the Yukon were more ten times those in Canada as a whole. However, such comparisons can be a little misleading. Many of the road miles which have been built in the North have been justified by the need for access to resources areas, and have provided intercommunity transport only as a by-product. While this may also be true in the provinces, provincial highway systems are more directly related to intercommunity travel needs.

(b) Differences Between North and South

In many respects the transport problems of the North and the South are at opposite ends of the spectrum. Transportation costs in the South are rising in many cases due to sheer congestion and overloading of facilities. In the North, on the other hand, improved techniques of handling large volumes over long distances are increasingly reaching the cost threshold necessary for economic resource exploitation.

Factors such as weather, communications, geography, cost of fuel, availability of supply depots, terminal facilities and navigational aids which affect transport can vary widely over the North's vast area. This great variance of conditions has aided in bringing forth a host of different modes to cope with the various problems of northern transport. A partial list of the

TABLE 1

FEDERAL GOVERNMENT ROAD EXPENDITURES, CANADA AND TERRITORIES

	POPULATION			EXPENDITURE			PER CAPITA EXPENDITURE		
	Canada	N.W.T.	Y.T.	Canada $	N.W.T. $	Y.T. $	Canada* $	N.W.T.	Y.T.
1960	17,870,000	22,000	14,000	794,873,201	3,807,482	7,657,035	45	173	547
1965	19,571,000	25,000	15,000	1,585,376,209	7,379,227	8,397,910	80	284	560
1966	19,919,000	26,000	15,000	1,771,038,551	11,064,625	9,335,459	88	385	649
1967	20,405,000	29,000	15,000	1,724,341,360	11,871,032	12,674,647	84	396	845
1968	20,744,000	31,000	15,000	1,737,721,338	12,930,739	13,546,554	83	417	903

Source: Dominion Bureau of Statistics

* This figure includes the Yukon and the N.W.T. as a part of Canada.
Excluding them would have virtually no effect on the per capita for Canada figures.

various modes used in, or which might be considered for, the North is:

railways	pipelines
all weather roads	winter roads
skylines	ice bridges
tracked vehicles	trucks & wheeled vehicles
skidoos and bombardiers	hovercraft
STOL air services	float and air ski
regular air (CTOL)	transfer & storage facilities
barge (inland marine)	ocean marine
Supertankers (Manhattan)	submarine tankers ?

Table 2 presents estimates of comparative ton-mile rates for many of these modes.

While the total cost per ton mile of transporting goods is usually the most important consideration for a shipper, other elements in the North also bear on the transport decision. Speed and reliability of service may be important considerations if shippers can realize savings through lower inventories. Regularity or seasonality of service can be a crucial consideration given the short construction season in the North. The promptness and regularity of air transport have in many cases far outweighed the cost differential of air transport over other competing modes.

(c) Lessons from Underdeveloped Areas

In many ways, Canada's North is similar to other underdeveloped areas. The North is primary industry oriented, export oriented and thus vulnerable to world market fluctuations, has a small

TABLE 2

COMPARATIVE TON-MILE RATES FOR DIFFERENT TRANSPORTATION MODES

Mode	Vehicle or Craft	Cost/Ton Mile (in cents)
Air Cushion Vehicles	SNR 6	100
	Hovermarine HM_2 (sidewall type)	50
Tractor Train		100
Aircraft	G_4 Helicopter (load 500 lbs.)	400
	Helicopter (load 3-4 tons)	125
	Helicopter (loan 10 tons)	50
	DeHavilland Otter	100
	DH Twin Otter	70
	DH Beaver	130
	Bristol	30
	C 130 Hercules	15
	Boeing 747 f	5
	Boeing tilt wing (20 ton load)	30
Truck	Std highway vehicles on winter road	20
	Std highway vehicle on highway	8
Rail	Std equipment (northern railways)	7
Marine	Ships on northern supply operations	5
	Barge in Mackenzie	4
	Super tanker in Arctic	?
	Cargo submarine in Arctic	?
Pipeline	Standard in south	.1
	Northern pipeline	?

Note: the ton-mile rates for aircraft and ACV's would double if the craft returns with no load. The costs shown are based on charter rates where these have been established, and include depreciation of capital as well as fuel and crew.

Source: E. Weick and C. Merrill, "A Look at the Future" North Queen's Printer, Ottawa, 1969. P.70.

capital market, and has a considerable foreign ownership content in its industrial sector. However, the North differs from many underdeveloped areas in that its resource base is probably very large, it has a very sparse population, and a stable government.

A first lesson to be learned from the experiences of other underdeveloped areas is that we must break out of the "development for development's sake" syndrome. The traditional way of dealing with transport problems is government subsidy. Subsidies to transport infrastructure brings settlement, settlement of course brings volume, and volume brings unit costs down, thereby solving or at least ameliorating the problem. The major problem with this approach is that new towns and settlements place very large demands on government for social services of all sorts with the result that the perceived (government) cost of development is often much lower than the actual cost of development. Another problem is that the scale of public participation required for development to proceed is not always as large as seems necessary at first sight (the Prudhoe Bay example was discussed earlier).

A second lesson to be learned is that care should be taken not to overextend the traditional transportation infrastructure less changing conditions should render it obsolete. The building of two transcontinental railroads in addition to the established C.P.R. line and their subsequent collapse and amalgamation into the C.N.R. in the early part of this century is a good example here. The Canadian Government is taking steps to avoid a costly duplication of facilities with its announcement that it will allow only one petroleum and one gas pipeline to be built down the Mackenzie River Valley.

(d) Social Needs

The question of whether or not government expenditures on transportation facilities in the North will be economic or not can, in most cases, be easily answered in the negative. However, social needs are a very important consideration in the underdeveloped North as they are in other underdeveloped areas, and must be considered in addition to economic needs. The question now becomes not "are such expenditures economic", but rather "how do we make the most use of scarce transport funds?". There is no clear cut answer to this latter question, as any final decision will depend on the policymaker making a value judgement as to the relative importance of the social need factor. The annual sealift from Montreal, a Federal Government operation which provides the eastern Arctic with supplies as well as supplying a medical staff to treat the native population and the Remote Airports Program of the Department of Indian Affairs and Northern Development to build ten airports over the next few years at remote settlements, are examples of "social need" oriented government transport expenditures in Canada's North.

Opinion among the experts is divided as to whether or not a pipeline (or pipelines) will be built on the Mackenzie River. The effects of a $2 billion investment in a Mackenzie Valley Pipeline and the spinoffs from such an investment on the underdeveloped northwest economy in general, and the native population in particular, will almost certainly be far reaching and large in magnitude. It is crucial that large infrastructure developments such as this include the social and cultural needs of the North in their cost calculations.

(e) Ecology

The North is the last great "frontier" in North America, and most of this region is still in its natural pristine state. While some would argue that all development of the North should cease and the area should be preserved as a great natural park, a more reasonable solution would appear to be that of controlled development, with developers taking account of and paying (in part or in full) for any ecological damage caused by themselves.

The ecology problem poses some particularly difficult problems for transportation due to the delicate nature of the northern environment and the volume of resource exploitation proposed. As an example of the kinds of things that can happen, two years ago a forest fire threatened the community of Inuvik and a firebreak was bulldozed one inch deep and 4 bulldozer blades wide. Unfortunately, the delicate permafrost balance was upset and today the firebreak is a mile long 12 foot deep gully and could become as deep as 50 feet.(5)

(f) Problems of Prediction

In order to sensibly determine transport priorities in the North, we need some sort of estimate of future demands for transport. The basic needs for transport in the North in the future will almost certainly be to exploit minerals and petroleum products, to move passengers, to move supplies, and to move machinery ancil-

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(5) See the Montreal Gazette, September 29, 1970. The Canadian Government has taken the initiative on the ecology problem and fairly extensive legislation is in effect for northern areas.

lary to the production process. As the resource potential of the North is still largely unknown, the northern economy is subject to "shock effects" (viz. Prudhoe Bay) with the result that changes in commodity flow volumes over, say, 15 years would be so great relative to the base year for which data were available, as to preclude the use of models calibrated for that base year.(6)

Even in cases where the resource base is known, accurately predicting future transport needs is difficult as many variables can affect and change the development pattern. Consider, for example, the extensive Casino copper-molybdenum deposits north of Whitehorse in the Yukon and the large deposits of iron ore on Baffin Island. Whether or not these large projects come on stream depends on many factors, among them, transport technology, world markets, mining technology, the availability and cost of power, and the availability and cost of capital. A change in any or all of these factors could easily determine whether or not these projects are economically feasible.

(g) Awareness of Alternatives

It is crucial that all alternatives are carefully examined and full allowance made for possible future technological developments as "outmoded thinking concerning transportation technology or the premature hardening of the system in the wrong places can hinder northern development through a misapplication of development capital and imposing higher transportation costs upon sub-

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(6) R. Soberman, "Transport Technology - Some Considerations for the North". A paper presented to the Alaska Science Conference, Whitehorse Y.T., 1968. P.3.

sequent development than necessary".(7) Flexibility, however, is usually only obtained at the price of higher transport costs (in the short run at least). Generally speaking, those transport technologies with a high ratio of sunk capital to operating costs (e.g. railroads) are characterized by lower costs per unit of output, reliability, higher risk (if sufficient volumes do not materialize), and greater inflexibility in meeting changing conditions and demands. Thus there is a trade-off between cost and risk associated with choices between various modes.(8)

Administration is a difficult problem in the North due to the great distances between population centres. While there is a need to administer these areas, it is not at all clear that the only way this need can be met is by moving people around. In many cases, it may be more convenient to move ideas rather than people. Instant and complete communication (via television phone hook-ups) would obviate the need for much business travel, and would necessarily greatly increase working efficiency. While present day communication technology is far from being perfect, the alternative of moving information as opposed to moving people should be carefully examined, particularly with respect to central government administrative functions and requirements.

Another area in which alternatives to traditional thought should be considered is in the individual firm calculations to design specific transportation systems to serve one resource area.

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(7) G. Rogers, "Alaska" an article in North published by the D. of Indian Affairs and Northern Development, 1969, P.37.

(8) R. Soberman, op.cit., P.5.

A reasonable alternative to this traditional approach would be to concentrate investment and encourage settlement in larger centres and discourage smaller company towns with small populations. All the (considerable) company investment in new towns could thus be avoided (except for marginal facilities - bunkhouses), and transportation to and from the site could be provided by, say, air facilities.

Given the advanced state of air technology, daily flights of several hundred miles would appear to be feasible. Concentrating settlement in larger centres would lead to economies of scale in providing services and the cost of daily air transport would likely be lower than those incurred by traditional solutions when all costs including social costs are considered. Important economies of scale could also be realized by concentrating investment in "transportation corridors"[9] (including such things as road facilities, pipelines, power supply, storage facilities, communications facilities, etc.) wherever possible for the use of many different interests as opposed to "one firm one investment" decisions. The Mackenzie River basin seems suitable to this type of investment.

If one was to crystal ball and speculate on what is likely in the future of the North, a safe statement would appear to be that the future development of the North will undoubtedly be greatly affected by air transport technology development. Of particular interest here are air cushion vehicles (ACV's). ACV's have the

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(9) See R. Rohmer's, The Green North McLean Hunter Limited, Toronto, 1970.

great advantage over other modes in that they can travel over any relatively level surface, be it ice, snow, swamp or water, whereas the other modes are specialized beasts requiring their own specialized and costly surfaces. The ACV also has the great advantage of not affecting or damaging the surface over which it travels, and as the ACV can travel over many surfaces, the possibilities for cost savings through reduced handling of freight in many instances is obvious.

The Federal Government has supported field trials of the ACV and a fair amount is known about their performance in northern conditions. All the amphibious type A (hovercraft) have installed horsepower in the ratio of approximately 100 horsepower per ton of all up weight, and this heavy power requirements results in a ton-mile cost of 10 cents for fuel alone, and a range of about 200 miles.(10)

As a general comment, at their present level of development, ACV's seem to be best suited for moving passengers and not freight over distances of less than 100 miles. However, given the rapid rate that technology is overcoming obstacles and solving problems(11) it seems most likely that large freight carrying ACV's will become economic propositions in the not too distant future. The implications of this for all underdeveloped areas are great indeed. In Clarke's words -

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(10) E. Weick and C. Merrill, op. cit., p.72.

(11) The speed at which technology is progressing should not be underestimated. For example, Bell Aerospace of Buffalo, N.Y., is presently working on a 4,000 ton hoverfreighter designed to cruise at 100 mph (i.e. cross the Atlantic Ocean in two days). Cargo would be containerized and only a small crew would be required to operate vessels of this type which may see service in the late 1970's.

> "...with the emancipation of traffic from the road, we will at last have achieved real mobility over the face of the earth. The importance of this to Africa, Australia, South America, Antarctica, and all countries that lack (and now may never possess) well developed highway systems can scarcely be overestimated."(12)

Similarly, the (future) ability to load a containerized Hover-freighter in, say, Winnipeg, and then ship direct to London, England will obviously have widespread repercussions on present multi-modal transportation systems.

Whether or not these large ACV'S will prove feasible in the North remains to be seen, and any present opinion on this matter would be at best a guess. One thing that is reasonably certain, however, is that new ideas and technology will be continually becoming available to assist in solving northern transportation problems. A careful examination of all possible alternative solutions to northern problems is necessary if some of the mistakes of more developed regions are to be avoided.

III. A RATIONAL APPROACH

Rational is basically that which makes sense, and as transportation is a means and not an end, a rational approach is to use transportation planning to maximum effect as a means to achieving some goal.(13) This paper assumes a desirable goal to be the

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(12) A.C. Clarke, Profiles of the Future, A Bantam Book, Harper and Row, New York, N.W., 1967.

(13) Alice (in Wonderland) asked the Cheshire Cat "Which way shall I go?" to which the cat replied "That depends a great deal on where you want to get to". Similar logic applies to the problem of transportation planning, as what is rational depends on what goal or goals transportation planning attempts to realize.

"balanced development" of the North and evaluates the term rational in this context. A rational approach is seen to be one that: (a) accurately accounts for all costs and benefits of transportation decisions, (b) is fully co-ordinated as a part of an overall development plan, and (c) is flexible and amenable to future change.

An enlightened benefit-cost approach which accurately accounts for all the relevant measurable costs and benefits involved in any given transport decision, and at least attempts to account for those costs and benefits not easily quantified,[14] is the first component of a rational transportation plan. The economic problem in the North is that of making the most effective use of a given (due to government budget restraint) amount of scarce capital, and so projects should be ranked according to their benefit-cost ratios, in other words, the top ranked project would be that project which yielded the maximum benefits for a given cost outlay.

As development has been assumed to be the end for transport planning, a national income approach which involves a consideration of the economy with and without a given investment will be the proper type of benefit-cost analysis to employ. In other words, the national income approach measures the total impact of transport decisions on the area or economy under consideration.

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(14) There are many things it is virtually impossible to put a price on such as the value of a human life, the value of a lovely sunset, etc. While we may be unable to accurately quantify all benefits and costs, we can usually identify the direction of a given effect - eg. positive effect - improve recreational facilities.

While the benefit-cost approach is fraught with difficulties and shortcomings,[15] the relative costs and benefits of alternate transport decisions must be considered if meaningful choices are to be made. The total benefits and costs of a given decision will consist of tangible measurable components (eg. construction costs, O&M expenses, various primary and secondary revenue streams) and intangible components (eg. ecological costs, recreation benefits). The weighting or importance given to the latter factors will, of course, be largely determined by the value judgements of the decision maker.

Volumes have been written on the problems and possibilities of measuring the gains from public investments, yet despite this, no satisfactory guage for measuring the gains from improved transportation has been developed.[16] While this paper does not offer any new insights into solving the problems of benefit-cost analysis, it does assert that the first step towards a rational ransport plan is an awareness of and a consideration of all the relative costs and benefits involved in any given decision.

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(15) Some of the many difficulties involved include: (1) Benefit-Cost ratios can be manipulated by changing the assumptions of the analysis, (2) problems of who benefits - this is important given the large foreign ownership content in the northern economy, (3) It must be noted that even ideally accurate cost-benefit information would not guarantee that the most beneficial of two similar (equal cost) projects would be implemented as vested interests can and do affect final decisions, and (4) problems of distribution arise - eg. is it better that 3 individuals benefit by $500 each or that 14 individuals benefit by $100?

(16) D.F. Pegrum, op.cit., p.15.

Investing in transport technology is an area where public investment may yield large and widespread benefits given the presence of large untapped resources in the Arctic areas. For example, the development of an effective ice breaking technology would 'open up' the Arctic Islands, the huge Baffin Island iron ore deposits, the North Slope area, and would have far reaching implications for the whole Arctic area.

A second area where public investment could yield large returns is in the supplying of meteorological and navigational aids of all kinds. Public investment is necessary here as the private sector is unable to effectively capture the benefits (i.e. charge prices) for the use of such investments.

The second component of a rational transport plan is that public transportation planning must be fully coordinated with other development policies in aiming at a common goal. In other words, transport planning must be tailored to fit the overall development scheme and not vice versa.

The third component of a rational transport policy is a "flexibility" component. The North is changing rapidly and transport technology itself is changing at a very rapid pace. Great care must be taken that traditional methods of solving transport problems are not followed blindly without given due consideration to the great weight of a very rapidly changing transportation technology. Care should also be taken that all possible solutions are examined so that the trap of "name-tagging" projects can be avoided.

While it is true that flexibility in transport can only be achieved by paying a price, given the rapid acceleration of transport technology, the price appears to be worth paying. Prudhoe

may revolutionized our thinking about the possible benefits of pipeline and supertanker technology. Similarly, the discovery of a large gold mine in the Arctic tundra would undoubtedly affect our thinking as to what viable solutions to the "transport problem" are.

IV. SUMMARY AND CONCLUDING REMARKS

The salient points and considerations raised in this paper are as follows:

(1) Transportation has been and will continue to be of paramount importance to the overall development of the North.

(2) Considerable differences exist between the North and the rest of Canada with respect to population densities, transport infrastructure, etc. with the result that solutions to "southern" transport problems are seldom applicable to northern situations.

(3) As new settlements usually result in heavy demands for government social services of all kinds, public transport planning should (other things equal) attempt to keep the scattering of population to a minimum.

(4) The social and cultural needs of the northern population and the fragile northern ecology are two factors which must be considered in any transport plan decision. As it is virtually impossible to put meaningful dollar values on these factors, the final weighting will depend on a value judgement of the decision maker.

(5) A rapidly changing and developing transport technology and a North that is still subject to "shock effects" such as Prudhoe Bay, make long term predictions of future demand for transport a very difficult task. Given the rapid rate of change, a higher cost (in the short run) flexible policy is to be preferred to a 'lower cost' inflexible policy.

(6) Alternative solutions to transport problems should be carefully considered in order to avoid a premature hardening of the transport infrastructure and imposing heavier costs on future development than necessary. The alternatives of moving information as opposed to moving people and the alternative of concentrating investment in larger centres as opposed to company towns are suggested in this paper.

(7) Rational is basically that which makes sense, and as transport is a means to an end, a rational approach is to use transport planning to maximum effect towards achieving a desired goal.

(8) If a balanced development is assumed as a desirable end in the North, a rational approach to public transport planning would include: (a) evaluating projects with an enlightened benefit-cost analysis, (b) coordinating transport planning with other development tools, and (c) keeping transport planning as flexible as possible given the rapidly changing northern scene.

If we fully understand the needs of the North and are aware of the alternative methods of dealing with the problems involved in planning northern transportation, viable solutions should be

forthcoming. While this paper is "long on problems and short on solutions", surely a full appreciation of the difficulties involved is necessary before attempting to derive a solution to any given problem.

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